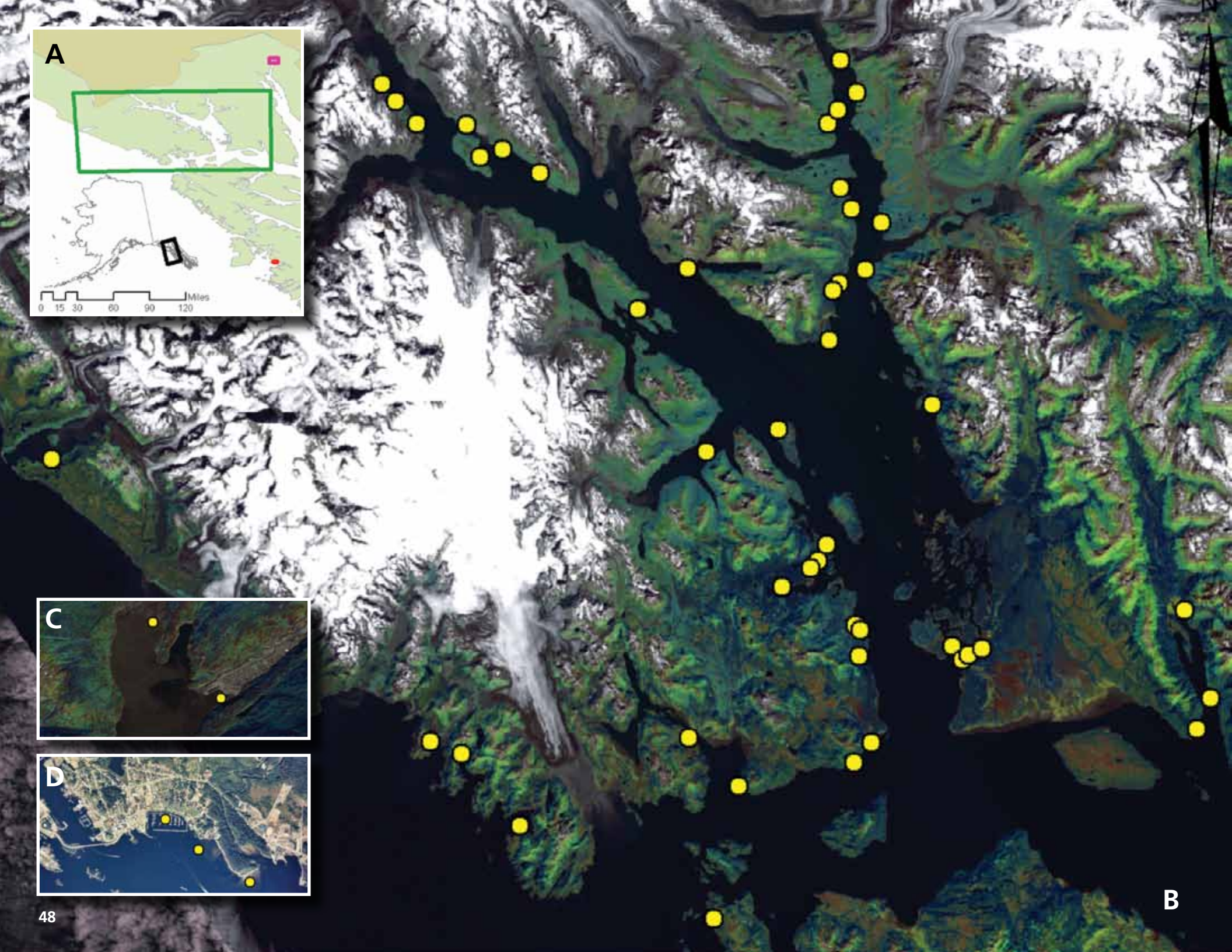
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A Marine Contaminants Assessment Suggests a Clean Intertidal Zone in Southeast Alaska Parks

By David A. Tallmon

Seemingly pristine and protected parks and natural areas can be negatively impacted by contaminants from distant, as well as nearby, sources. Contaminants can take many forms and threaten a variety of ecosystems and species. In the last few decades, research has shown that some contaminants can reach high latitudes from distant sources via different transport mechanisms and can accumulate in food chains, threatening the health of top predators and humans (*MacDonald et al. 2003, AMAP 2004*). There is increasing evidence from a broad array of studies that pollution created at relatively warm, low latitude sources can be transported to colder, higher latitudes via the "grasshopper effect" (*AMAP 2004*). Consequently, locales in northern regions can have surprisingly high levels of contaminants that are not broadly used or created nearby (*Engstrom and Swain 1997*). Recent research has shown that contaminants from a wide range of sources are a serious concern, even though the Gulf of Alaska is among the most pristine marine ecosystems yet tested for contaminants (*Hurwich and Chary 2000, Wright et al. 2000, Gabrielsen et al. 2003*).

To assess current contaminant levels in Southeast Alaska parks (SEAN) and to determine whether these levels are high enough to be of concern, we examined three categories of contaminants in bay mussels collected at numerous sites (*Figure 1*). Mussels are useful study organisms because they are sessile filter feeders and live up to 20 years, providing insight into contamination that has occurred over the previous several years, while also serving as indicators of any recent catastrophic events. In addition, mussels are regularly collected for marine contaminant monitoring throughout the U.S. (*Kimbrough et al. 2008*). This provides us with the opportunity to compare our results to a massive, long-term database for mussels collected along the entire Pacific and Atlantic seaboards of the U.S.

Over 50 mussel samples were collected from Glacier Bay National Park (GLBA), Sitka National Historical Park (SITK), and Klondike Gold Rush National Historical Park (KGLO). These were analyzed for contaminant levels in three major categories: metals, polyaromatic hydrocarbons (PAHs), and persistent organic pollutants (POPs).

Metal contamination levels are low throughout SEAN intertidal zones. For example, arsenic and cadmium reach concentrations of 1 part per million (ppm) in mussels from only a few locations, and are very low values relative to the lower 48 states. Similarly, mercury levels are low throughout SEAN (< 0.03 ppm). Interestingly, the highest levels of mercury and tributyltin in this study are from a mussel sample collected in Crescent Harbor, Sitka, which has heavy boat use. Overall, the values for these metals are low relative to those found in both Alaska and the rest of the U.S. (*Kimbrough et al. 2008*). This suggests that SEAN, and southeastern Alaska in general, are relatively unaffected by metal contaminants in the intertidal zone.

Similarly, results show low levels of PAH and POP contamination in SEAN parks. Only a total of 11 samples included in this study are above the lower detection limit for PAHs, and these are almost all from heavy human use sites that were selected with an expectation of observing relatively high contamination levels. Results from this and other studies of a variety of plants and fishes inhabiting this and other parts of the U.S. generally suggest PAH contamination in SEAN is low (*Landers et al. 2008, Olsen et al. 2008*).

The region also shows low levels of contamination in the major POP groups analyzed. All but one site sampled

Figure 1. Locations of mussels sampled for contaminants analysis. (A) Map of the SEAN region with GLBA outlined in green, KLGO outlined in pink, and SITK in red. The yellow dots on the other maps indicate sampling sites within and near each park: (B) GLBA, (C) KLGO, and (D) SITK.

NPS photograph


NPS photograph

Figure 2. Mussels are common throughout the intertidal zone and were sampled for this study to examine marine contaminants.

have chlordane levels too low to be detected. Similarly, only seven sites have detectable DDT levels, and all of these are far below 5 parts per billion (ppb). All of these sites are heavy human use areas in or near KLGO, SITK, and GLBA. Only two sites have hexachlorocyclohexane levels that are above detection limits. Again, however, these values are very low (< 1 ppb), and provide little evidence this contaminant is a problem in the intertidal zone of SEAN. Although PCB levels are above detection limits in many samples, they are still extremely low in all but a few samples. In keeping with the PAH analyses, the sites with relatively high PCB and PBDE levels for the SEAN region have heavy human use, and would be categorized as low when compared to the most recent data taken across the U.S. (*Kimbrough et al. 2008*).

Although there are some sites with heavy human use that show evidence of contamination in southeastern Alaska, the analyses provide a clean bill of health for the intertidal zone of SEAN. In addition, the patterns suggest that at this point in time, there is no large, distant source of contaminants affecting SEAN at a level we can detect in the intertidal zone. Hopefully, this pattern will hold over time, and SEAN will remain the set of relatively pristine, uncontaminated jewels of Alaska that they are today.

Acknowledgements

This work was made possible by the contributions of many National Park Service employees, including: Scott Gende, Brendan Moynahan, Lewis Sharman, Chad Soiseth, Bill Johnson, Justin Smith, Deb Johnson, and Geof Smith. Kathy Smikrud and Peter Flynn provided the GIS maps presented here and helped with sample site identification. Micaela Ponce, Andrew Whiteley, and Erik Lokensgaard assisted with field collections.

NPS photograph

Figure 3. Mussels are an abundant component of the intertidal ecological community.

Photograph courtesy of David Tallmon

Figure 4. Micaela Ponce and Erik Lokensgaard collect mussles in the west arm of GLBA.

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